EXPANSION JOINT HOLDER AND A METHOD OF POURING CONCRETE SECTIONS

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CLASSIFICATION: class/subclass 52/396.02

FIELD OF THE INVENTION

The present invention relates to construction and building materials and methods and more particularly, to a concrete section expansion joint holder enabling the positioning and holding of an expansion joint rubber strip to produce straight expansion joints with less effort and time.

BACKGROUND OF THE INVENTION

Concrete expansion joints are an essential component in the proper construction of many large concrete surfaces, such as floors, roofs, parking lots, roads, airport runways and the like. These joints enable expansion and contraction of the concrete or mortar surfaces based on surrounding temperatures, which reach hot and cold extremes, respectively, in summer and winter periods, and other factors including shifting of soil underneath the slabs. These joints are meant to eliminate the deterioration of the slab due to random cracks which otherwise form in the concrete.

As used herein the term "joints" applies equally to expansion and contraction joints.

Concrete sidewalks, streets, patios and other large expanses of concrete in addition to having edges along the sides of the slabs typically have numerous transverse joints, often at intervals of every few feet. In cold climates, such transverse joints may be formed having a thin expansion joint constructed of a strip of felt-like or rubber or elastomeric flexible material to permit expansion and contraction of adjacent slabs of the sidewalk without cracking. Expansion joints typically are made from materials such as asbestos-impregnated cellulosic material, plastic, and fibrous mesh which withstand weathering and aging. In other instances, concrete slabs may be divided by strips of wood, such as 2 x 4's to provide an appearance which is usually considered more attractive than a large, undivided concrete slab. In any event, such dividing of large areas of concrete into smaller areas permits the settling of the slab without cracking, each smaller slab being permitted to move somewhat relative to the other slabs by the dividing boards. In the absence of being divided in this manner into smaller concrete areas, a large area concrete slab is prone to crack due to thermal expansion and contraction and ground settling.

Cast concrete slabs are used for roadways, sidewalks, driveways and the like. The slabs have a coefficient of thermal expansion requiring that space be provided between adjacent slabs to allow the slabs to expand and contract thermally without stressing the slabs sufficiently to fracture or rupture the concrete. It is conventional to provide for thermal expansion of the slabs by

placing asphalt treated mat expansion joints between the adjacent slabs. These joints are resilient and permit expansion of the concrete.

Asphalt joints are commonly used but have a number of disadvantages. The joints are flexible and must be backed up by a board during pouring of the concrete. Also, these joints can easily float when the liquid concrete is poured into the form. The backup board must be kept in place while pouring the adjacent slab. After the adjacent slab is poured the board is removed, taking care to maintain the asphalt joint in place and the contractor must fill additional concrete into the space previously occupied by the board. This is a time consuming and inefficient process.

In time, conventional asphalt joints tend to become compressed and separate from the ends of the adjacent slabs, allowing water to flow down into the spaced between the slabs. This water may freeze, expand and injure the slabs. Also, the asphalt joints tend to work up above the top of the slabs forming well known highway "bumps". Working up of asphalt joints creates voids in the space between the slabs where water can collect, freeze and injure the slabs. The seal between the joints and the slabs is also degraded.

In concrete constructions such as sidewalks and driveways, expansion joints provide that the concrete slabs, rather than breaking, may move to eliminate stress due to environmental elements such as water freezing under the concrete. For example, a typical sidewalk has expansion joints positioned about every five feet and a typical driveway has expansion joints about every eight feet.

In a typical concrete construction, wooden forms, held in place by stakes, confine fresh concrete. Specifically, the wooden forms are placed in desired locations and then expansion joints typically are placed adjacent to one side of the forms. Wooden or steel pegs hold the forms and joints in the desired position. Concrete then is poured in the areas defined by the forms. Since it is impractical to pour concrete a section at a time, it is necessary to pour a large amount of coverage at one time and then work the concrete as it begins to harden. A skillful concrete finisher will know just about when he can enter onto the concrete, usually on some large flat surface such as a section of plywood, and remove the forms. The expansion joints are left in place and a worker then fills interstices left by removing the forms with fresh concrete after which the entire slabs are allowed to set.

U. S. Patent No. 4,198,176 to Bentz discloses a concrete expansion joint forming structure in which a U-shaped metallic continuous sheet holder supports an expansion joint of wood or other decorative joint material. The holder is supported on a pair of chisel-shaped pegs driven into the ground before pouring concrete around the area to set the expansion joints. The joint forming structure is encased in the poured concrete.

U.S. Patent No. 4,875,801 to Montrym discloses an expansion joint brace with ground pegs for setting the brace before pouring concrete and alignment pegs to hold an expansion joint. The brace must be removed from the poured concrete prior to the setting or curing of the concrete.

U.S. Patent No. 6,598,364 to Pelles discloses an adjustable height concrete expansion joint maker comprising a longitudinal planar section which is shaped to hold an expansion joint and where the longitudinal section can be adjusted in height such that the upper edge of the expansion joint are visible in the poured concrete.

Concrete sidewalks are typically made by pouring concrete into a pre-formed frame comprised of, for instance, two-by-four boards. After the concrete is cured, the board frame is removed. To reduce the possibility of the expansion or contraction of the concrete, expansion joints are typically used. Generally, a gap is made between adjacent slabs of concrete. The gap contains an expansion joint which is a material which can compress when the concrete expands. Such material can be inserted into gaps after the concrete has cured or can be positioned prior to the pouring of the concrete. The latter method typically uses an elastomeric, flexible strip of material as the expansion joint. This flexible strip is positioned in the concrete frame and held in place by placing two-by-four boards immediately on either side of the strip. These two boards brace the strip upright and keep it straight so that the resulting joint is straight. In this method, the frame is partially filled with concrete and, by hand, one support board is removed while concrete is pressed up against the strip. The second board is removed and concrete is hand pressed against the strip.

This method is problematic because it is time-consuming, laborious and does not assure straight, vertical expansion joints since the rubber strip can move around once one or both of the support boards is removed. The problem

therefore is to position expansion joints between adjacent portions of concrete which are straight and require less time and effort to make so as to increase efficiency in pouring adjacent concrete portions, such as in sidewalks and driveways.

This invention solves this problem by providing an expansion joint holder which grips the expansion strip firmly such that the need for support boards is eliminated, there is less laborious hand-work necessary for finishing the expansion joint and the resultant joint is straight.

SUMMARY OF THE INVENTION

The present invention overcomes the disadvantages of prior art concrete expansion joints by providing a concrete section expansion joint holder that holds an expansion joint such that the resulting joint is substantially straight, wherein the holder does not need to be removed either during or after the pouring of the concrete, thereby allowing more efficient pouring of concrete over large layout surfaces.

In accordance with the present invention, there is provided a concrete section expansion joint holder for placement prior to pouring a concrete slab surface requiring an expansion joint, comprising:

at least two support components shaped for holding an expansion joint

and at least two rods attached to said at least two components

wherein said rods are substantially parallel to each other, said at least support two components are in planes substantially parallel to each other and said rods are approximately perpendicular to said parallel planes.

In a preferred embodiment, the concrete section expansion joint holder comprises five support components each of which is made from 3/16 inch (about 0.48 cm) diameter steel wire and the rods made of steel that is 7/16 inches (about 1.11 cm) diameter steel.

Also provided is a process of pouring concrete requiring an expansion joint using the concrete section expansion joint holder.

The present invention also provides a concrete slab comprising an expansion joint comprising at least two support components shaped for holding an expansion joint and at least two rods attached to said at least two components wherein said rods are substantially parallel to each other, said at least support two components are in planes substantially parallel to each other and said rods are approximately perpendicular to said parallel planes.

BRIEF DESCRIPTION OF THE DRAWINGS

Figures 1a and 1b are a schematic drawing of one of the support components of the inventive concrete section expansion joint holder.

Figure 2 is a schematic drawing of the concrete section expansion joint holder of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The phrase "resulting joint is substantially straight" as used herein means the expansion joint is linear and not wavy or curved.

The phrase "substantially parallel" as used herein means planes which are less than about 10 degrees, preferably less than about 5 degrees and more preferably less than about 2 degrees off of parallel.

Figure 1a shows a support component 19 which is integral to the instant invention.

Each shaped support component 19 comprises two legs (21 and 23) angled at an acute angle with respect to each other and continuous with each other. The two legs are continuous with and in the same plane as a substantially U- shape that serves as a slot for insertion of an expansion joint. One side of the U-shape forms one side of substantially a right triangle having vertexes A, B and C wherein leg 21 connects vertices A and B and part of leg 23 connects vertices B and C. This right triangle is in the same plane as the U-shape. The bottom of the U-shape is near to leg 23 and is optionally attached to it. Spot-welding may be used to achieve this optional attachment. The width of the slot in the U-shape is equal or slightly smaller than the thickness of the material to be used as

the expansion joint so that the expansion joint is held in a reasonably snug relationship. Preferably, the slot is about 7/16 inch (about 1.11 cm) wide for use with an elastomeric expansion joint that is 0.5 inches (about 1.3 cm) thick and is thus held snugly in place. The height of the slot is no greater than the desired height of the concrete slab and is of sufficient height to hold the expansion joint securely upright. For instance, the slot is no greater than 4 inches (about 10.2 cm) tall for use in pouring concrete sidewalks or and no greater than 6 -8 inches (about 15.2 to 20.3 cm) for use in concrete driveways. Preferably, for a 4 inch thick concrete application, requiring a 4 inch high expansion joint, the slot is approximately 2 inches (about 5.1 cm) tall. Preferably for a 6 inch thick concrete application, requiring a 6 inch high expansion joint, the slot is approximately 4 inches tall.

Shaped support components may be made of any material that is flexible enough to be bent and shaped and stiff enough to maintain the bends and shapes to hold an expansion joint during the pouring and curing of concrete. Typically the material is a metal, such as steel or aluminum. Preferably this material is 3/16 inch diameter (about 0.48 cm) steel wire.

Figure 1b shows a cross-sectional view in the plane of the support component 19 where the U-shaped slot is holding an expansion joint 25. Rods 13 and 15 are used to secure support components to each other thus creating the expansion joint holder. Each support component serves multiple functions: it provides the slot to secure the expansion joint and it serves as the support for the expansion joint holder itself. A concrete section joint device of the instant

invention comprises at least two of the described support components attached to two rods 13 and 15. The rods are attached to the shaped support components such that the two rods are substantially parallel to each other and perpendicular to the plane of each of the shaped support components. One rod 13 is attached to each vertex A of each of at least two components such that it maintains substantial contact with the expansion joint. Thus, this rod is attached to vertex A outside of the substantially right triangle. Rod 15 is attached to each vertex B of each of the said at least two components. Rod 15 may be attached to vertex B either inside or outside of the substantial right triangle. If attached outside, it is attached such that rod 15 and leg 23 of each of the support components are in substantially the same plane and define the surface upon which the joint device rests when in use in pouring concrete sections. If attached inside, the surface upon which the joint holder rests when in use is defined by the legs 23 of each of the support components.

The support components are separated by a distance sufficient to provide a stable surface for the joint holder and to maintain the held expansion joint straight. As the length of the rods increases, additional support components are used to construct the holder. The support components are approximately 10-12 inches (about 25.4 to 30.5 cm) apart when the rods are 44 inches (about 111.8 cm) long. One of skill in the art however can readily determine different spacing between the support components and adjust it to achieve the desired result.

Figure 2 shows one embodiment of the instant invention. In this preferred embodiment, the expansion joint holder 27 comprises five support components

19 each of which are attached to rod 13 and rod 15. Rods 13 and 15 are parallel to each other and are approximately perpendicular to the plane of each of the five support components 19. In this preferred embodiment the length of the two rods 13 and 15, and thus of the joint device, is about 44 inches (about 111.8 cm) and the five support components 19 evenly spaced along the 44 inch length and thus are separated by approximately 10-12 inches. The attachment of the rods to the support components is by means of spot welds in this preferred embodiment. In this preferred embodiment, the slot width is 7/16 inches, the support components are made from 3/16 inch diameter steel wire and the rods are made of 7/16 inch diameter steel.

The rods need to be made from any material that is a) stiff to keep the joint maker straight so the resulting expansion joint is straight, b) strong enough to support the joint maker when formed and c) can be securely attached to the support components. Typically this material is a metal, such as steel or aluminum. Preferably, the rods are made of 7/16 inch diameter steel. If desired, this material can also be bendable such that it holds the bent shape; preferred for this application is 4.5 mm steel. This feature allows for curving the expansion joint. This application is useful for curves in sidewalks, for instance around a swimming pool, in parks around fountains, and in children's playgrounds around playground equipment.

In pouring a concrete sidewalk or driveway, a frame to confine or retain the poured liquid concrete is constructed. At each site where an expansion joint is desired, the inventive expansion joint holder is placed into the frame and the

expansion joint is slid into the slots of each of the shape support components. This is what is meant by the phrase "for placement prior to pouring a concrete slab", used herein. The concrete is then poured into the frame.

The expansion joint holder is fully compatible with the use of rebar for reinforcing the poured concrete. "Rebar" is a rod of steel placed within the frame and encompassed by the poured concrete to provide strength and reinforce the concrete when cured. Furthermore, plural devices can be "tied" together to hold a longer expansion joint in an application requiring a wider width.

The expansion joint holder becomes fully encased by the poured concrete while maintaining the expansion joint in a straight line, or optionally, in a curve. There is no need for time-consuming extensive staking down or two-by-four bracing of flexible, floppy, elastomeric expansion joints. Thus the inventive concrete section expansion joint holder obviates the need for a removal step of two-by-four expansion joint braces and for a step of hand pressing concrete against the expansion joint during the finishing.

While expansion joints are typically transverse, the invention may also advantageously be used longitudinally, for instance to provide further strength. It is also contemplated that a third rod could be attached to leg 21 and adapted to use as a rebar chair, that is a device to support rebar.

While this invention has been described with respect to the preferred specific embodiments, it will be understood that many modifications and

variations may occur to those skilled in the art without departing from the spirit and scope of this invention as defined in the claims.